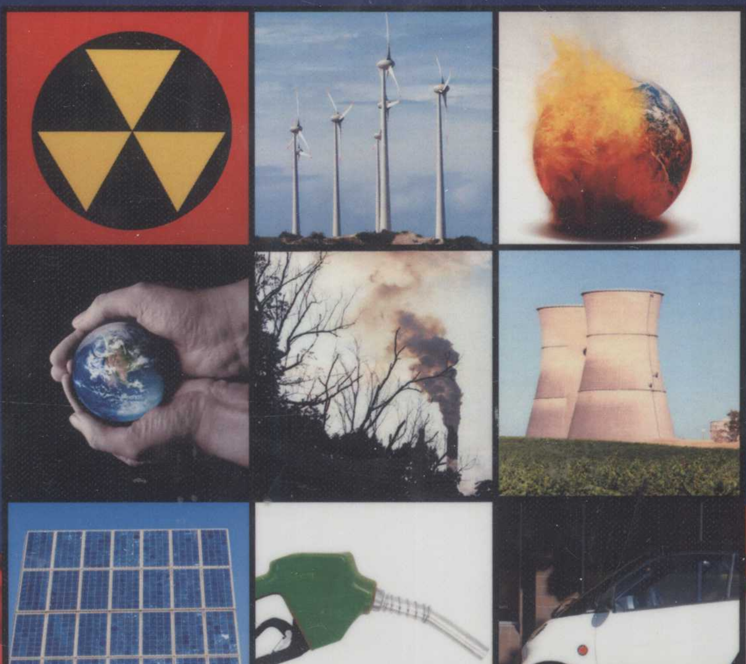
Energy Policies, Politics and Prices

U.S. Energy and the Environment

An Overview and Comparative Analysis



Roland H. Terrison
Editor

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ENERGY POLICIES, POLITICS AND PRICES

U.S. ENERGY AND THE ENVIRONMENT: AN OVERVIEW AND COMPARATIVE ANALYSIS

ROLAND H. TERRISON
EDITOR

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PREFACE

Energy supplies and prices are major economic factors in the U.S., and energy markets are volatile and unpredictable. As an aid in policy making, this book presents a current and historical view of the supply and consumption of various forms of energy. With the downturn in the world economy and a consequent decline in consumption, prices collapsed, but the dependence continues as a potential problem. Other energy supplies discussed herein are: The Manhattan Project, the Apollo Program, and the Federal Technology R&D Programs; Nuclear Waste Disposal-Alternatives to Yucca Mountain; Biochar-An Examination of an Emerging Concept to Mitigate Climate Change; Alternative Fuels and Advanced Technology Vehicles; Carbon Tax and Greenhouse Gas Control; and the Environmental Quality Incentives Program (EQIP).

Chapter 1 - Some policymakers have concluded that the energy challenges facing the United States are so critical that a concentrated investment in energy research and development (R&D) should be undertaken. The Manhattan project, which produced the atomic bomb, and the Apollo program, which landed American men on the moon, have been cited as examples of the success such R&D investments can yield. Investment in federal energy technology R&D programs of the 1970s, in response to two energy crises, have generally been viewed as less successful than the earlier two efforts. This chapter compares and contrasts the three initiatives.

In 2008 dollars, the cumulative cost of the Manhattan project over 5 fiscal years was approximately $22 billion; of the Apollo program over 14 fiscal years, approximately $98 billion; of post-oil shock energy R&D efforts over 35 fiscal years, $118 billion. A measure of the nation's commitments to the programs is their relative shares of the federal outlays during the years of peak funding: for the Manhattan program, the peak year funding was 1% of federal outlays; for the Apollo program, 2.2%; and for energy technology R&D programs, 0.5%. Another measure of the commitment is their relative shares of the nation's gross domestic product (GDP) during the peak years of funding: for the Manhattan project and the Apollo program, the peak year funding reached 0.4% of GDP, and for the energy technology R&D programs, 0.1%.

Besides funding, several criteria might be used to compare these three initiatives including perception of the program or threat, goal clarity, and the customer of the technology being developed. By these criteria, while the Manhattan project and the Apollo program may provide some useful analogies for thinking about an energy technology R&D initiative, there are fundamental differences between the forces that drove these historical R&D success stories and the forces driving energy technology R&D today. Critical differences include (1) the ability to transform the program or threat into a concrete goal, and (2) the use to which the technology would be put. On the issue of goal setting, for the Manhattan project, the response to the threat of enemy development of a nuclear bomb was the goal to construct a bomb; for the Apollo program, the threat of Soviet space dominance was translated into a specific goal of landing on the moon. For energy, the response to the problems of insecure oil sources and high prices has resulted in multiple, sometimes conflicting, goals. Regarding use, both the Manhattan project and the Apollo program goals pointed to technologies primarily for governmental use with little concern about their environmental impact; for energy, in contrast, the hoped-for outcome depends on commercial viability and mitigation of environmental impacts from energy use.

Although the Manhattan project and the Apollo program may provide some useful analogies for funding, these differences may limit their utility regarding energy policy. Rather, energy technology R&D has been driven by at least three not always commensurate goals—resource and technological diversity, commercial viability, and environmental protection—which were not goals of the historical programs.

Some policymakers have concluded that the energy challenges facing the United States are so critical that a concentrated investment in energy research and development (R&D) should be undertaken. The Manhattan project, which produced the atomic bomb, and the Apollo program, which landed American men on the moon, have been cited as examples of the success such R&D investments can yield. Investment in federal energy technology R&D programs of the 1970s, in response to two energy crises, have generally been viewed as less successful than the earlier two efforts. This chapter compares and contrasts the goals of, and the investments in, the three initiatives, which may provide useful insights for Congress as it assesses and debates the nation's energy policy.

Chapter 2 - designated Yucca Mountain, NV, as the nation's sole candidate site for a permanent high-level nuclear waste repository in 1987, following years of controversy over the site-selection process. Over the strenuous objections of the State of Nevada, the Department of Energy (DOE) submitted a license application for the proposed Yucca Mountain repository in June 2008 to the Nuclear Regulatory Commission (NRC). During the 2008 election campaign, now-President Obama lent support to Nevada's fight against the repository, contending in an issue statement that he and now-Vice President Biden "do not believe that Yucca Mountain is a suitable site."

Under the current nuclear waste program, DOE hopes to begin transporting spent nuclear fuel and other highly radioactive waste to Yucca Mountain by 2020. That schedule is 22 years beyond the 1998 deadline established by the Nuclear Waste Policy Act (NWPA). Because U.S. nuclear power plants will continue to generate nuclear waste after a repository opens, DOE estimates that all waste could not be removed from existing reactors until about 2066 even under the current Yucca Mountain schedule. Not all the projected waste could be disposed of at Yucca Mountain, however, unless NWPA's current limit on the repository's capacity is increased.

If the Obama Administration decides to halt the Yucca Mountain project, it has a variety of tools available to implement that policy. Although the President cannot directly affect NRC proceedings, the Secretary of Energy could withdraw the Yucca Mountain license application under NRC rules. The President could also urge Congress to cut or eliminate funding for the Yucca Mountain project, and propose legislation to restructure the nuclear waste program.

Abandonment of Yucca Mountain would probably further delay the federal government's removal of nuclear waste from reactor sites and therefore increase the government's liabilities for missing the NWPA deadline. DOE estimates that such liabilities will reach $11 billion even if Yucca Mountain opens as currently planned. DOE's agreements with states to remove defense-related high-level waste could also be affected. If the Yucca Mountain project were halted without a clear alternative path for waste management, the licensing of proposed new nuclear power plants could be affected as well. NRC has determined that waste can be safely stored at reactor sites for at least 30 years after a reactor shuts down and is proposing to extend that period to 60 years. While that proposal would allow at least 100 years for waste to remain at reactor sites (including a 40-year reactor operating period), NRC's policy is that new reactors should not be licensed without "reasonable confidence that the wastes can and will in due course be disposed of safely."

Current law provides no alternative repository site to Yucca Mountain, and it does not authorize DOE to open temporary storage facilities without a permanent repository in operation. Without congressional action, therefore, the default alternative to Yucca Mountain would be indefinite on- site storage of nuclear waste at reactor sites and other nuclear facilities. Private central storage facilities can also be licensed under current law; such a facility has been licensed in Utah but its operation has been blocked by the Department of the Interior.

Congress has considered legislation repeatedly since the mid-1990s to authorize a federal interim storage facility for nuclear waste but none has been enacted. Reprocessing of spent fuel could reduce waste volumes and long-term toxicity, but such facilities are costly and raise concerns about the separation of plutonium that could be used in nuclear weapons. Storage and reprocessing would still eventually require a permanent repository, and a search for a new repository site would need to avoid the obstacles that have hampered previous U.S. efforts.

Chapter 3 - Energy supplies and prices are major economic factors in the United States, and energy markets are volatile and unpredictable. Thus, energy policy has been a recurring issue for Congress since the first major crisis in the 1970s. As an aid in policy making, this chapter presents a current and historical view of the supply and consumption of various forms of energy.

The historical trends show petroleum as the major source of energy, rising from about 38% in 1950 to 45% in 1975, then declining to about 40% in response to the energy crisis of the 1970s. Significantly, the transportation sector has been and continues to be almost completely dependent on petroleum, mostly gasoline. The importance of this dependence on the volatile world oil market was revealed over the past five years as perceptions of impending inability of the industry to meet increasing world demand led to relentless increases in the prices of oil and gasoline. With the downturn in the world economy and a consequent decline in consumption, prices collapsed, but the dependence on imported oil continues as a potential problem.

Natural gas followed a similar pattern at a lower level, increasing its share of total energy from about 17% in 1950 to more than 30% in 1970, then declining to about 20%. Consumption of coal in 1950 was 35% of the total, almost equal to oil, but it declined to about 20% a decade later and has remained at about that proportion since then. Coal currently is used almost exclusively for electric power generation.

Nuclear power started coming online in significant amounts in the late 1960s. By 1975, in the midst of the oil crisis, it was supplying 9% of total electricity generation. However, increases in capital costs, construction delays, and public opposition to nuclear power following the Three Mile Island accident in 1979 curtailed expansion of the technology, and many construction projects were cancelled. Continuation of some construction increased the nuclear share of generation to 20% in 1990, where it remains currently. The first new reactor license applications in nearly 30 years were recently submitted, but no new plants are currently under construction or on order.

Construction of major hydroelectric projects has also essentially ceased, and hydropower's share of electricity generation has gradually declined, from 30% in 1950 to 15% in 1975 and less than 10% in 2000. However, hydropower remains highly important on a regional basis.

Renewable energy sources (except hydropower) continue to offer more potential than actual energy production, although fuel ethanol has become a significant factor in transportation fuel, and wind power has recently grown rapidly. Conservation and energy efficiency have shown significant gains over the past three decades and offer encouraging potential to relieve some of the dependence on imports that has caused economic difficulties in the past, as well as the present.

After an introductory overview of aggregate energy consumption, this chapter presents detailed analysis of trends and statistics regarding specific energy sources: oil, electricity, natural gas, coal and renewable energy. A section on trends in energy efficiency is also presented.

Chapter 4 - Biochar is a charcoal produced under high temperatures using crop residues, animal manure, or any type of organic waste material. Biochar looks very similar to potting soil. The combined production and use of biochar is considered a carbon-negative process, meaning that carbon is removed from the atmosphere and will not be released into the atmosphere at a later time.

Biochar has multiple potential environmental benefits, foremost the potential to sequester carbon in the soil for hundreds to thousands of years at an estimate. Studies suggest that crop yields can increase as a result of applying biochar as a fertilizer to the soil. Some contend that biochar has value as an immediate climate change mitigation strategy. Scientific experiments suggest that greenhouse gas emissions are reduced significantly with biochar application to crop fields.

Obstacles that may stall rapid adoption of biochar production systems include technology costs, system operation and maintenance, feedstock availability, and biochar handling. Biochar research and development is in its infancy. Nevertheless, interest in biochar as a multifaceted solution to agricultural and natural resource issues is growing at a rapid pace both nationally and internationally.

Past Congresses have proposed numerous climate change bills, many of which do not directly address mitigation and adaptation technologies at developmental stages like biochar. However, biochar may equip agricultural and forestry producers with numerous revenue-generating products: carbon offsets, fertilizer, and energy. A clearly defined policy medium that supports this technology has yet to emerge (e.g., soil conservation, alternative energy, climate change).

This chapter briefly describes biochar, its potential advantages and disadvantages, legislative support, and research and development activities underway in the United States and abroad.

Chapter 5 - Alternative fuels and advanced technology vehicles are seen by proponents as integral to improving urban air quality, decreasing dependence on foreign oil, and reducing emissions of greenhouse gases. However, major barriers—especially economics—currently prevent the widespread use of these fuels and technologies. Because of these barriers, and the potential benefits, there is continued congressional interest in providing incentives and other support for their development and commercialization.

Alternative fuels and advanced technology vehicles have been addressed early in the 111th Congress, as both the House and Senate versions of the American Recovery and Reinvestment Act of 2009 (H.R. 1) contained provisions supporting their development and deployment. While some of these provisions were removed in conference, the final version still contains provisions for tax incentives, federal grants and loans, and other federal support for alternative fuels and advanced vehicles.

The 111th Congress is likely to further discuss alternative fuels and advanced technology vehicles as it addresses other key topics. These include their role in any federal policy to address climate change, and their role in federal energy policy. The 111th Congress may also play an oversight role in the development of major regulations: the Environmental Protection Agency's implementation of the renewable fuel standard enacted in 2005, and expanded in 2007; the Department of Transportation's implementation of new fuel economy standards enacted in 2007; and the Department of Agriculture's implementation of a new Farm Bill enacted in 2008.

In the 110^{th} Congress, alternative fuels and advanced technology vehicles received a good deal of attention, especially in discussions over U.S. energy security. In his January 24, 2007, State of the Union Address, President Bush called for the increased use of renewable and alternative motor fuels to 35 billion gallons annually by 2017. U.S. consumption was roughly five billion gallons in 2006. Therefore, such an initiative would mean a seven-fold increase in the use of these fuels over 11 years. On December 19, 2007, President Bush signed the Energy Independence and Security Act of 2007 (EISA, P.L. 110-140). EISA requires an increase in renewable fuel consumption to 9.0 billion gallons in 2008 and 36 billion gallons in 2022. Further within the 36- billion-gallon requirement, by 2022 the law mandates the use of 21 billion gallons of "advanced biofuels," defined as fuel derived from renewable biomass other than corn starch, with 50% lower lifecycle greenhouse gas emissions compared to petroleum fuels. The 110^{th} Congress also enacted the Food, Conservation, and Energy Act of 2008 (2008 Farm Bill, P.L. 110-246)—which expanded and extended incentives for biofuels—as well as the Emergency Economic Stabilization Act of 2008 (EESA, P.L. 110-343)—which modified existing fuel tax credits, and established a tax credit for the purchase of plug-in vehicles.

Chapter 6 - Market-based mechanisms that limit greenhouse gas (GHG) emissions can be divided into two types: quantity control (e.g., cap-and-trade) and price control (e.g., carbon tax or fee). To some extent, a carbon tax and a cap-and-trade program would produce similar effects: Both are estimated to increase the price of fossil fuels, which would ultimately be borne by consumers, particularly households. Although there are multiple tools available to policymakers that could control GHG emissions—including existing statutory authorities—this chapter focuses on a carbon tax approach and how it compares to its more frequently discussed counterpart: cap-and-trade.

If policymakers had perfect information regarding the market, either a price (carbon tax) or quantity control (cap-and-trade system) instrument could be designed to achieve the same outcome. Because this market ideal does not exist, preference for a carbon tax or a cap-and-trade program ultimately depends on which variable one wants to control—emissions or costs. Although there are several design mechanisms that could blur the distinction, the gap between price control and quantity control can never be completely overcome.

A carbon tax has several potential advantages. With a fixed price ceiling on emissions (or their inputs—e.g., fossil fuels), a tax approach would not cause additional volatility in energy prices. A set price would provide industry with better information to guide investment decisions: e.g., efficiency improvements, equipment upgrades. Economists often highlight a relative economic efficiency advantage of a carbon tax, but this potential advantage rests on assumptions—about the expected costs and benefits of climate change mitigation—that are uncertain and controversial. Some contend that a carbon tax may provide implementation advantages: greater transparency, reduced administrative burden, and relative ease of modification.

The primary disadvantage of a carbon tax is that it would yield uncertain emission control. Some argue that the potential for irreversible climate change impacts necessitates the emissions certainty that is only available with a quantity-based instrument (e.g., cap-and-trade). Although it may present implementation challenges, policymakers could devise a tax program that allows some short-term emission fluctuations, while progressing toward a long-term emission reduction objective. Proponents argue that short-term emission fluctuations would be preferable to the price volatility that might be expected with a cap-and-trade system.

Although a carbon tax could possibly face more political obstacles than a cap-and-trade program, some of these obstacles may be based on misunderstandings of the differences between the two approaches or on assumptions that the tax would be set too low to be effective. Carbon tax proponents could possibly address these issues to some degree, but there remains considerable political momentum for a cap-and-trade program.

Chapter 7 - The Environmental Quality Incentives Program (EQIP) is a voluntary program that provides farmers with financial and technical assistance to plan and implement soil and water conservation practices. EQIP is the largest agriculture conservation financial assistance program for working lands. EQIP was first authorized in 1996 and was most recently revised by Section 2501 of the Food, Conservation, and Energy Act of 2008 (P.L. 110-246, the 2008 farm bill). It is a mandatory spending program (i.e., not subject to annual appropriations) and is administered by the U.S. Department of Agriculture's (USDA's) Natural Resources Conservation Service (NRCS). Funding is currently authorized to grow to $1.75 billion in FY20 12. Eligible land includes cropland, rangeland, pasture, non-industrial private forestland, and other land on which resource concerns related to agricultural production could be addressed through an EQIP contract.

With the 111th Congress facing tighter budget constraints, EQIP could face similar challenges with a potential reduction in mandatory funding levels and a continuing backlog of unfunded applications. A change in income limitations along with a new waiver created in the 2008 farm bill could also raise issues for the program. EQIP will also continue to face challenges in measuring environmental and program accomplishments.

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Chapter 1

THE MANHATTAN PROJECT, THE APOLLO PROGRAM, AND FEDERAL ENERGY TECHNOLOGY R&D PROGRAMS: A COMPARATIVE ANALYSIS

Deborah D. Stine

SUMMARY

Some policymakers have concluded that the energy challenges facing the United States are so critical that a concentrated investment in energy research and development (R&D) should be undertaken. The Manhattan project, which produced the atomic bomb, and the Apollo program, which landed American men on the moon, have been cited as examples of the success such R&D investments can yield. Investment in federal energy technology R&D programs of the 1970s, in response to two energy crises, have generally been viewed as less successful than the earlier two efforts. This chapter compares and contrasts the three initiatives.

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THE MANHATTAN PROJECT

The Manhattan project took place from 1942 to 1946.[1] Beginning in 1939, some key scientists expressed concern that Germany might be building an atomic weapon and proposed that the United States accelerate atomic research in response. Following the Pearl Harbor attack in December 1941, the United States entered World War II. In January 1942, President Franklin D. Roosevelt gave secret, tentative approval for the development of an atomic bomb. The Army Corps of Engineers was assigned the task and set up the Manhattan Engineer District to manage the project. A bomb research and design laboratory was built at Los Alamos, New Mexico. Due to uncertainties regarding production effectiveness, two possible fuels for the reactors were produced with uranium enrichment facilities at Oak Ridge, Tennessee, and plutonium production facilities at Hanford, Washington. In December 1942, Roosevelt gave final approval to construct a nuclear bomb. A bomb using plutonium as fuel was successfully tested south of Los Alamos in July 1945. In August 1945, President Truman decided to use the bomb against Japan at two locations. Japan surrendered a few days after the second bomb attack. At that point, the Manhattan project was deemed to have fulfilled its mission, although some additional nuclear weapons were still assembled. In 1946, the civilian Atomic Energy Commission was established to manage the nation's future atomic activities, and the Manhattan project officially ended.

According to one estimate, the Manhattan project cost $2.2 billion from 1942 to 1946 ($22 billion in 2008 dollars), which is much greater than the original cost and time estimate of approximately $148 million for 1942 to 1944.[2] General Leslie Groves, who managed the Manhattan project, has written that Members of Congress who inquired about the project were discouraged by the Secretary of War from asking questions or visiting sites.[3] After the project was under way for over a year, in February 1944, War Department officials received essentially a "blank check" for the project from Congressional leadership who "remained completely in the dark" about the Manhattan project, according to Groves and other experts.[4]